# SUSTAINABLE RANGES FOR A TRANSFORMED ARMY

Dr. M. John Cullinane,
Robert M. Lacey, and
CPT Tyrone Farmer

## Introduction

Effective training of soldiers, leaders, and units is vital to ensuring that the Army is ready to successfully accomplish its battle-focused missions. Effective training should allow soldiers and leaders to practice individual and unit mission-essential tasks under realistic and challenging conditions. To facilitate effective training, the Army developed and continues to improve its training infrastructure. This infrastructure includes combined-arms training centers and a vast array of training areas, ranges, and target systems designed to increase individual skills and unit tactical and technical proficiency with a variety of sophisticated weapon systems.

Maintaining individual, leader, and collective skills and ensuring the readiness posture of the force is critical to meeting Objective Force training requirements and requires intense management of the Army's considerable investment in training ranges. As the Army's transformation progresses, these same ranges must support Interim and Legacy Forces into the year 2015, with some installations simultaneously supporting all three force types. This will put extreme pressure on training lands. Environmental issues and public opinion already have a serious impact on training and must be key considerations in planning, designing, operating, and maintaining future ranges if the Army is to sustain its training capability and force readiness.

The Army, a predominantly land-based force, requires substantial land area for maneuver and live-fire training. As the Army transitions to the Objective Force, with its anticipated increased footprint, the land area requirements for effective training are expected to increase. The acquisition of new training lands is politically and economically problematic. This situation makes maximum effective use of current Army-owned lands an imperative to support the training needs of the Objective Force.

## Background

The Army's ability to maintain its training mission has been adversely affected by a variety of range and training land issues. These issues have evolved in recent years and are likely to continue at an accelerated pace. First, installations must comply with a tremendous number of new and demanding environmental regulations. These regulations cover multiple environmental aspects related to installation support and training missions. Second, many installations are no longer isolated pieces of ground. Many installations are surrounded by urban and suburban populations that no longer view the installation and its economic benefit to the community as major factors in long-term development. As a result, public scrutiny of installation activities has increased. Third, the military force is transforming. In past years, modernization to faster, heavier, more capable weapon systems had an impact on the availability of training lands, and this trend is anticipated to continue. Finally, previous training activities have either contaminated or degraded thousands of acres, making them unusable for training.

The Army must manage range sustainment pressures at all major installations, training sites, and proving grounds. This will minimize environmental and public conflicts and future constraints, and support the ability to train to proficiency. Range designs and maintenance procedures must integrate explosive safety, cleanup, environmental compliance, pollution prevention, and natural resources management to ensure training environment availability both now and in the future.

The U.S. Army Engineer Research and Development Center (ERDC) conducts research supporting installation transformation toward usable and sustainable ranges. One area of this research involves development of better, cheaper, faster, and safer methods of assessing and remediating contaminated training lands and restoring them to beneficial use. Other research focuses on live-fire range design and maintenance to meet the Army's current and future training needs. Both efforts provide information and tools that support "Fort Future" modeling and simula-

tion activities. Another article on Fort Future begins on Page 14 of this issue of *Army AL&T*.

## Cleanup Research

*Site Characterization and Monitoring.* The current focus of this research is the characterization of unexploded ordnance (UXO) on contaminated lands. The limited capabilities of current technologies to detect, identify, discriminate, and remediate UXO are well documented. ERDC research is quantifying the effects of the environment, geology, and manufactured non-UXO objects (clutter) on candidate UXO detection, discrimination, identification, and location approaches and developing technologies to mitigate these effects.

Laboratory and field measurements are used to quantify and model the electromagnetic, magnetic, and ground-penetrating radar (GPR) signatures emanating from UXO and non-UXO targets under a variety of environmental and geophysical conditions. The collected information and the validated models will be used to specify sensor selection, detection survey and sampling procedures, and signature analyses based on site-specific environmental and geologic conditions.

Specific technologies under investigation include time and frequency domain electromagnetic induction; high-resolution, fully polarimetric GPR; magnetometers and gradiometers; and high-accuracy navigation and tracking systems. Advanced signal and image processing algorithms and multisensor data fusion techniques are being developed to support expert system or neural network applications (algorithm development) as well as automatic target recognition methods.

The projected 90 percent reduction in the number of false alarms will reduce the cost and time required to remediate UXO-contaminated sites by 75 percent. The demonstrated detection capability for the full range of UXO types to their maximum penetration depths will enhance acceptance by regulators and local stakeholders and will expedite the transition of ranges to productive use.

*Risk Quantification and Assessment.* Sustainable environmental management of active firing ranges requires the use of risk assessment tools and data to assess contaminant release, contaminant fate and transport, and contaminant effects. Currently, Army environmental restoration project and range managers are faced with constraints on both the quantity and quality of information needed to conduct credible risk assessments necessary to make informed and supportable decisions regarding restoration options. Limited information on the fate, transport, and toxicology of military-unique chemicals results in risk estimates that are highly uncertain and extremely conservative. Continued overreliance on such approaches has resulted in overly conservative cleanup levels that can only be attained using cost-prohibitive environmental remediation strategies.

The goal of risk quantification and assessment research is to produce new techniques that allow timely and accurate risk assessments. Land managers use these assessments in making land-use decisions. Research conducted under this thrust area provides more certain knowledge of the toxicology, fate, and transport of military contaminants, and the streamlining of the risk assessment process. The procedures and methodologies developed under this research effort are available through the Army Risk Assessment Modeling System (ARAMS). Developed through formal, collaborative interactions with several other federal agencies, ARAMS will be used outside the Army to evaluate cleanup operations at other contaminated sites.

Although the costs associated with remediation activities are expected to greatly exceed those of assessing the site risks, assessment costs alone can be substantial, ranging from $25,000 to more than $1 million per site. Using ARAMS will reduce the time required to conduct a risk assessment from years to months and result in more realistic cleanup targets.

## Live-Fire Range Research

ERDC is developing a range design risk assessment model to evaluate range site selection, design, and construction requirements against current and future environmental compliance requirements. Existing and conceptual (Objective Force) ranges will then be assessed using this model to determine the critical conflicts or choke points that might affect the sustainability of future range and training land operations. Future efforts include erosion control and development of selected critical range design specifications for use in new construction, retrofit, and range upgrade to reduce and facilitate maintenance and cleanup operations. A range compliance monitoring and carrying capacity methodology that focuses on weapons use will also be provided. Finally, researchers will examine surveillance technologies that control access to ranges and training areas.

To ensure accuracy and adequacy of all aspects of the live-fire range research effort, both the environmental and training communities will be involved in coordinating and reviewing the development, demonstration, validation, and implementation of products associated with this effort. To accomplish this, an initial execution team has been established to provide expertise in the critical elements. The Army Training Support Center ensures that the effort

*While efforts to upgrade training land and ranges to support the Legacy Force have been accomplished through range modernization, even greater capabilities will be required to support the Objective Force. Further, the Army in transition will need access to all available lands.*

maintains its military requirement focus. ERDC will perform or manage the research and development of the required technologies. The Army Environmental Center will provide demonstration, validation, and implementation support for selected tools. The U.S. Army Engineering and Support Center, Huntsville, AL, will provide engineering and demonstration and standardization support through the Range Mandatory Center of Expertise.

This research effort will assess and model internal and external environmental risk to training ranges; identify and develop range design elements that can be modified to reduce and mitigate environmental compliance risk; determine weapon carrying capacity to predict operation and maintenance requirements; and identify technologies to control access to ranges. To determine the carrying capacity of these models as well as their modeling capabilities, researchers will use demonstrations to field-validate and improve those target models that identify range and training land environmental compliance risk and mitigation responses. In addition, at least three selected range design options will receive a full-scale field demonstration. In the case of the risk model, the demonstration will identify high-priority environmental issues. For range design packages, the demonstration will be conducted in association with approved range Military Construction, Army projects. The munitions carrying-capacity model will be demonstrated in conjunction with the present Army training and testing area carrying capacity methodology.

## Conclusion

While efforts to upgrade training land and ranges to support the Legacy Force have been accomplished through range modernization, even greater capabilities will be required to support the Objective Force. Further, the Army in transition will need access to all available lands. Thus, remediating contaminated ranges and returning them to training use is essential. Our mission from the Army leadership is clear: W*e must ensure that the U.S. Army remains the superior combat power now, 25 years from now, and beyond*. To accomplish this, installation and range planning must address environmental issues affecting land availability and the capacity to train to requirements. The Army's environmental quality research will give planners the technologies they need to make strategic decisions about land use now and as the Objective Force evolves.

---

*DR. M. JOHN CULLINANE is Technical Director for Environmental Engineering and Cleanup at the U.S. Army Engineer Research and Development Center. He received his Ph.D. from the University of Texas at Austin and his J.D. from the Mississippi College School of Law. He is a graduate of the U.S. Army War College and is a Diplomat of the American Academy of Environmental Engineers.*

*ROBERT M. LACEY is Associate Technical Director for Military Lands at the Engineer Research and Development Center's Construction Engineering Research Laboratory in Champaign, IL. He received his B.S. in geography and his M.S. in city and regional planning from Southern Illinois University at Edwardsville.*

*CPT TYRONE FARMER is the Program Manager for the Live-Fire Range and Training Land Sustainability Effort at the Engineer Research and Development Center's Construction Engineering Research Laboratory. A member of the Army Acquisition Corps, he received his B.S. in civil engineering from North Carolina A&T University and his M.S. in civil engineering from the University of Missouri.*

---